Course: Air Pollution Control Engineering		
Language: English		
Lecturer: Prof. Vesna Tomašić		
TEACHING	**WEEKLY**	**SEMESTER**
Lectures	**2**	**30**
Laboratory	**1**	**15**
Seminar	**0**	**0**
		Overall: 45
		ECTS: 5

PURPOSE:

Understanding of the technical processes and equipments that are used in the air pollution control, with a special emphasis on the optimization of operating conditions, sizing/dimensions of the process equipments (process equipments design) and the development of integrated processes.

THE CONTENTS OF THE COURSE:

1st week
The complexities of the air pollution protection. The composition and structure of the atmosphere. Gaseous pollutants: main sources and sinks; health effects. Particulate matters or particulates (PM): physical and chemical properties, sources of PM. Odour emissions. Radioactivity in the atmosphere. Primary and secondary pollutants. Typical reactions in the atmosphere. Greenhouse effect, global warming and global climate change.

2nd week
The history of air pollutant legislation. Clasiffication of pollutants and determination of the pollutant concentration. Mechanisms of formation for the major group of pollutants.

3rd week
Solving of the air pollution problems (primary and secondary processes, integrated approach). Classification of the technical processes and devices for air protection and description of the basic principles of their work.

4th week
Particulates Emission Control. Basics (interaction of particulates with gas; particulates collection, particulates size characteristics, flow regime of particulates motion). Mechanical separation methods (gravity settler, centrifugal sedimentators, cyclones). Advantages and disadvantages, process equipments design.

5th week
Partial exam

6th week
Removal of the particulates matter using mechanical separation methods (electrostatic precipitators (ESP), fabric filters). Factors affecting performance. Advantages and disadvantages, process equipments design.

7th week
Removal of the particulates matter using mechanical separation methods (wet scrubbers). Collection mechanism and efficiency.

8th week
Gaseous emission control: wet scrubbers (absorption) Venturi scrubber, spray tower, packed tower. Dry scrubbers. Adsorption (physical and chemical). Factors affecting adsorption. Collection efficiency.

9th week
Gaseous emission control: condensation (contact condenser, surface condenser), membrane separation. Advantages and disadvantages.

10th week
Partial exam

11th week
Chemical waste gas treatment (thermal treatment, catalytic oxidation). Factors affecting incineration. Flaring.

12th week
Biological degradation of gaseous contaminations (biofilters, bioscrubbers, biotrickling reactors). Construction, principles of application, basic problems in design.

13th week
Reducing pollutant emissions from mobile sources. Catalytic converters (three way catalysts), catalytic filters.

14th
Partial exam

Laboratory: Catalytic oxidation of VOCs over monolith supported metal oxide catalysts.

GENERAL AND SPECIFIC COMPETENCE:

Application of the basic methodology of chemical engineering for the selection of process and device for air pollution control, understanding of the influences of different process values and parameters, mathematical modeling and design of the air pollution equipments.

KNOWLEDGE TESTING AND EVALUATION:

The course is given as a combination of lectures, exercises, home-works and periodic assessment of knowledge (3 partial exams). Compulsatory exercises must be passed in order to get access to the exam. The examination form may change from written to oral.

MONITORING OF THE COURSE QUALITY AND SUCCESSFULNESS:

Quality and performance will be monitored through student surveys, interviews with students during the teaching process and their success in exams.

LITERATURE:

N. de Nevers, Air Pollution Control Engineering, McGraw-Hill, N.Y., 1995.
H. Brauer, Y.B.G. Varma, Air Pollution Control Equipment, Springer-Verlag, Berlin, 1981.
R.A. Santen, P.W.N.M. van Leeuwen, J.A. Moulijn and B.A. Averil, Catalysis-An Integrated Approach, 2nd Ed., Studies in Surface Science and Catalysis, Vol. 123, Elsevier, Amsterdam, 1998.
A. Cybulski and J.A. Moulijn, Structured Catalysts and Reactors, Marcel Dekker, N.Y. , 1998.
C. D. Cooper, F.C. Alley, Air Pollution Control-A design Approach, Waveland Press, Long Grove, 2002.

R. M. Heck, R. J. Farrauto, S.T. Gulati, Catalytic Air Pollution Control: Commercial Technology, John Wiley & Sons, Int., New York, 2002.
H. de Lasa, B. Serrano, M. Salaices, Photocatalytic Reaction Engineering, Springer, New York, 2005.